UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/565,765	01/24/2006	Rudolf Gheczy	03872-0033US1	5520

23973 7590 12/14/2009
DRINKER BIDDLE & REATH
ATTN: INTELLECTUAL PROPERTY GROUP
ONE LOGAN SQUARE
18TH AND CHERRY STREETS
PHILADELPHIA, PA 19103-6996

EXAMINER	
WU, IVES J	
ART UNIT	**PAPER NUMBER**
1797	
MAIL DATE	**DELIVERY MODE**
12/14/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/565,765	**Applicant(s)** GHECZY ET AL.
	Examiner IVES WU	**Art Unit** 1797

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _31 August 2009_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _12-25_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _12-25_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

(1). Applicants' Remarks filed on 8/31/2009 has been received.

The rejection of claims 12-25 in prior Office Action dated 2/27/2009 is withdrawn in view of the present Remarks.

However, a new ground of rejections for claims 12-25 is introduced as follows.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(3). **Claims 12-20, 22, 24-25** are rejected under 35 U.S.C. 102(a) as being anticipated by Brennecke et al (US 6579343B2), evidenced by Erickson (US 4132766), Sweeney et al (US 5856533A).

As to a method for providing oxygen in a concentrated form comprising selectively absorbing oxygen from a gaseous mixture into a liquid medium and releasing the oxygen from the liquid medium, wherein the liquid medium comprising at least one ionic liquid, wherein the ionic liquid has a reversible, with regards to nitrogen, a selective oxygen-uptake capacity, liquid medium maintained at a temperature above the melting pint of the ionic liquid in **independent claim 12**, gaseous mixture being air in **claim 13,** Brennecke et al (US 6579343B2) disclose purification of gas with liquid ionic compounds (Title). It relates to provide a method for purifying a gas by contacting the gas with a liquid ionic compound (Abstract, line 1-2). Further purification to a higher-purity commercial product by removing oxygen with a LIC is contemplated (Col. 3, line 49-50). In another illustrative embodiment, low purity argon is purified by separating the oxygen impurity upon contact with a LIC. Other gases which may be purified include nitrogen and air (Col. 4, line 45-47). Recovery of the desired material may be accomplished by processes analogous to the regeneration mechanisms described above. Distillation, evacuation, or extraction with a supercritical fluid, and the like, will regenerate the

LIC and simultaneously recover the desired purified gas; recovery rates greater than 90% are not unexpected (Col. 3, line 13-19).

As to the method for providing oxygen in a concentrated form as a reaction partner for combustion or oxidation reactions in **independent claim 12,** it would be obvious to use the concentrated, pressurized oxygen for reaction partner for combustion or oxidation reactions as evidenced by Erickson (US 4132766) that oxygen being widely used in large amounts in various industries, predominantly in the manufacture of steel, and has the prospect of substantially greater consumption in future coal conversion and hydrogen generation processes.

As to the an ion of the ionic liquid comprising a functional group with selective affinity for oxygen in **claim 14,** wherein the ion to be an anion in **claim 16**, it would be obvious to have a functional group with selective affinity for oxygen in order to adsorb the oxygen from air, as evidenced by Erickson (US 4132766) that oxygen is separated from air by a regenerative chemical process. It is appreciated that the anion component of the LIC may impart acidic, basic, or natural properties to the LIC. Such properties may be conveniently considered when choosing the LIC to enhance the capacity or selectivity of the separation (Col. 5, line 43-47).

As to wherein the ion is cation in **claim 15,** Brennecke et al (US 6579343B2) disclose the cation in the Formula containing substituted aryl. The term "substituted aryl" refers to aryl as described herein, where from one to about three hydrogen atoms on the aryl, haloalkyl, alkoxy, haloalkoxy, alkylthio, haloalkylthio, alkylamino, alkanoyl, cyano, nitro, and the like (Col. 7-8), therefore, it includes the perfluorinated hydrocarbon residual, which would be selective affinity to oxygen.

As to wherein the liquid medium comprises perfluorinated residues in **claim 17**, Brennecke et al (US 6579343B2) disclose 1-butylpyridinium tetrafluoroborate, 1-butyl-3-methylimidazolium hexafluorophosphate, 1-butyl-3-methylimidazolium trifluoroacetate (Col. 9, line 42-55).

As to absorbing oxygen from gaseous mixture to be carried out by passing a finely divided stream of air into the liquid medium in **claim 18**, and trickle-bed in **claim 19,** a porous membrane in a membrane contact in **claim 20**, Brennecke et al (US 6579343B2) disclose contacting the LIC with the gaseous mixture maybe accomplished in any of variety ways. Contacting can occur by permeation through a supported liquid membrane or by use of

conventional liquid absorbers such as counter-current liquid absorbers and the like (Col. 6, line 6-14). The LIC may also be used in a conventional gas/liquid absorption unit-based system comprising a fixed bed (Col. 6, line 45-46). It would include trickle-bed and bubble-bed as evidenced by Sweeney et al that fixed beds, either trickle-bed or bubble-bed (Col. 2, line 45-47). as well known in the art that trickle-bed would have a finely divided stream of gas phase into the liquid medium as claimed.

As to the absorbed oxygen being released from the liquid medium by exposing the liquid medium microwaves in **claim 22**, Brennecke et al (US 6579343B2) disclose distillation, it would include using the microwave to heat the LIC as well known in the art that microwave is used for heating.

As to wherein the adsorbed oxygen is released from the liquid medium by increasing the temperature of the liquid medium in **claim 24,** wherein the adsorbed oxygen is released from the liquid medium by decreasing the pressure of the liquid medium in **claim 25,** Brennecke et al (US 6579343B2) disclose distillation, evacuation (Col. 3, line 6).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

(4). **Claim 21** is rejected under 35 U.S.C. 103(a) as being unpatentable over Brennecke et al (US 6579343B2), further in view of Ramprasad et al (EP 583748A1) and Voorhees (US 2196281).

As to wherein the absorbed oxygen is released from the liquid medium by passing combustion exhaust gases through the liquid medium in **claim 21**, Brennecke et al (US 6579343) discloses regeneration such as by distillation, evacuation, or by extraction with a supercritical fluid, such as supercritical carbon dioxide (Col. 3, line 6-8). Brennecke et al **does not teach** the use of stripping gas such as exhaust gas as claimed.

However, Ramprasad et al (EP 583748A1) **teach** method for recovering oxygen from oxygen-containing gaseous mixture (Title). In desorption step of cycle, the operating conditions of the absorber are changed by lowering the pressure and/or raising the temperature of the solution and passing a scrubber gas through the column to scrub at least a portion of the bound oxygen from the metal complex (page 2, line 30-33).

The advantage of using stripping gas for desorption is to improve the performance separation as well known in the art. Both Ramprasad et al, Brennecke et al do not teach the use of exhaust gas as stripping gas. However, it would include the exhaust gas for stripping as evidenced by Voorhees (US 2196281) that stripping gas, for example flue gas, air or steam may be supplied by line 20 at the base of the regenerator and heat may be supplied to the solution in the base of the regenerator by closed steam heating coil 21 (page 1, col. 2, line 19-23).

Therefore, it would have been obvious at time of the invention to install stripper disclosed by Ramprasad et al by using flue gas disclosed by Voorhees for the regeneration stage of Brennecke et al in order to achieve the cited advantages.

(5). **Claim 23** is rejected under 35 U.S.C. 103(a) as being unpatentable over Brennecke et al (US 6579343B2), in view of Horn et al (US 6682794B1).

As to absorbed oxygen to be released from liquid medium by catalytically degassing the liquid medium in **claim 23,** Brennecke et al (US 6579343B2) disclose evacuation (Col. 3, line 6). Brennecke et al **do not teach** catalytically degassing the liquid medium as claimed.

However, Horn et al (US 6682794) **teach** polycarbonate containers (Title). It is prepared by the phase interface process that is characterized in that the aqueous solution of an alkali salt of a bisphenol used, contains dissolved oxygen in an amount less than 150 ppb. (Abstract). Oxygen is removed from the fully deionized water in a manner known in principle, e.g, catalytically, by degassing or by inert gas stripping (Col. 3, line 12-14).

The evacuation method is genus, the catalytically degassing is species, one of ordinary skills in the art would recognize that all species work well for genus, motivated by reasonable expectation of success. In re O'Farrell, 853 F.2d 894, 903, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988).

ALTERNATIVELY, CLAIMS 12-25 ARE REJECTED IN THE FOLLOWING:

(6). **Claims 12-20, 22, 24-25** rejected under 35 U.S.C. 103(a) as being unpatentable over Cassano (US 4529775), in view of Brennecke et al (US 6579343B2) ,evidenced by Erickson (US 4132766).

As to a method for providing oxygen in a concentrated form comprising selectively absorbing oxygen from a gaseous mixture into a liquid medium and releasing the oxygen from the liquid medium, wherein the liquid medium comprising at least one ionic liquid, wherein the ionic liquid has a reversible, with regards to nitrogen, a selective oxygen-uptake capacity, liquid medium maintained at a temperature above the melting pint of the ionic liquid in **independent claim 12**, gaseous mixture being air in **claim 13,** Cassano (US 4526775) discloses oxygen production by molten alkali metal salts using multiple absorption-desorption cycles (Title). A greater recovery of high pressure oxygen is achieved at reduced power requirements and capital costs (Abstract, line 6-8). It is directed to a process for the continuous chemical separation of **air** into oxygen and nitrogen in which pressurized **air** is contacted in an absorption zone with an oxygen acceptor which becomes oxidized, the oxidized oxygen acceptor is separately decomposed by pressure reduction in a desorption zone to yield oxygen and regenerated oxygen acceptor and the regenerated oxygen acceptor is recycled to the absorption zone (Col. 2, line 30-38).. Preferably the oxygen acceptor comprises a molten solution of alkali metal nitrite and alkali metal nitrate (Col. 2, line 55-56). Preferably the **oxygen acceptor constitutes a composition which is liquid and remains liquid when reacted with air at process conditions** (Col. 3, line 51-53). Cassano **does not teach** the use of ionic liquid for the absorption and desorption as claimed.

However, Brennecke et al (US 6579343B2) **teach** purification of gas with liquid ionic compound (Title). It relates to provide a method for purifying a gas by contacting the gas with a liquid ionic compound (Abstract, line 1-2). Further purification to a higher-purity commercial

product by removing oxygen with a LIC is contemplated (Col. 3, line 49-50). In another illustrative embodiment, low purity argon is purified by separating the oxygen impurity upon contact with a LIC. Other gases which may be purified include nitrogen and air (Col. 4, line 45-47).

The advantage of using ionic liquid is to have negligible vapor pressures under ambient conditions and often form stable liquids at temperatures up to about 300^{o} C (Col. 5, line 36-39). Their low vapor pressure minimizes loss of absorbing material during use and provides a simple mechanism for regeneration, such as by distillation, evacuation, or by extraction with a supercritical fluid, such as supercritical carbon dioxide (Col. 3, line 3-6). LICs can be distinguished from conventional “molten salts”, such as sodium chloride, requiring excess temperatures (>250^{o} C) (Col. 5, line 33-35).

Therefore, it would have been obvious at time of the invention to replace the molten salt of Cassano with ionic liquid of Brennecke et al in the process of absorbing, desorbing oxygen of Cassano in order to achieve the advantages cited above.

As to the method for providing oxygen in a concentrated form as a reaction partner for combustion or oxidation reactions in **independent claim 12,** it would be obvious to use the concentrated, pressurized oxygen for reaction partner for combustion or oxidation reactions as evidenced by Erickson (US 4132766) that oxygen being widely used in large amounts in various industries, predominantly in the manufacture of steel, and has the prospect of substantially greater consumption in future coal conversion and hydrogen generation processes.

As to the an ion of the ionic liquid comprising a functional group with selective affinity for oxygen in **claim 14,** wherein the ion to be an anion in **claim 16**, it would be obvious to have a functional group with selective affinity for oxygen in order to adsorb the oxygen from air, as evidenced by Erickson (US 4132766) that oxygen is separated from air by a regenerative chemical process. Brennecke et al (US 6579343B2) disclose that the anion component of the LIC may impart acidic, basic, or neutral properties to the LIC. Such properties may be conveniently considered when choosing the LIC to enhance the capacity or selectivity of separation (Col. 5, line 43-47).

As to wherein the ion is cation in **claim 15,** Brennecke et al (US 6579343B2) disclosed the cation in the Formula containing substituted aryl. The term “substituted aryl” refers to aryl as

described herein, where from one to about three hydrogen atoms on the aryl, haloalkyl, alkoxy, haloalkoxy, alkylthio, haloalkylthio, alkylamino, alkanoyl, cyano, nitro, and the like (Col. 7-8), therefore, it includes the perfluorinated hydrocarbon residual, which would be selective affinity to oxygen.

As to wherein the liquid medium comprises perfluorinated residues in **claim 17**, Brennecke et al (US 6579343B2) disclose 1-butylpyridinium tetrafluoroborate, 1-butyl-3-methylimidazolium hexafluorophosphate, 1-butyl-3-methylimidazolium trifluoroacetate (Col. 9, line 42-55).

As to absorbing oxygen from gaseous mixture to be carried out by passing a finely divided stream of air into the liquid medium in **claim 18**, and trickle-bed in **claim 19,** a porous membrane in a membrane contact in **claim 20**, Brennecke et al (US 6579343B2) disclose contacting the LIC with the gaseous mixture maybe accomplished in any of variety ways. Contacting can occur by permeation through a supported liquid membrane or by use of conventional liquid absorbers such as counter-current liquid absorbers and the like (Col. 6, line 6-14). The LIC may also be used in a conventional gas/liquid absorption unit-based system comprising a fixed bed (Col. 6, line 45-46). It would include trickle-bed and bubble-bed as evidenced by Sweeney et al that fixed beds, either trickle-bed or bubble-bed (Col. 2, line 45-47). as well known in the art that trickle-bed would have a finely divided stream of gas phase into the liquid medium as claimed.

As to the absorbed oxygen being released from the liquid medium by exposing the liquid medium microwaves in **claim 22**, Cassano (US 4526775) discloses the heat requirement of the endothermic decomposition reaction. It would be obvious to use microwave as well known in the art that microwave is used for heating.

As to adsorbed oxygen to be released from the liquid medium by increasing the temperature of the liquid medium in **claim 24**, and by decreasing the pressure of the liquid medium in **claim 25**, Cassano (US 4526775) discloses, particularly, high energy efficiencies to be achieved when the respective oxidation and decomposition reactions are conducted in heat exchanger relationship with one another, whereby the exothermic heat from the oxidation reaction supplies the **bulk of heat** requirement of endothermic decomposition reaction (Col. 3,

line 44-50). Under the **reduced pressure**, the oxygen is released from the oxygen acceptor and exits the vessel in overhead line 28 (Col. 4, line 59-61).

(7). **Claim 21** is rejected under 35 U.S.C. 103(a) as being unpatentable over Cassano (US 4526775), in view of Brennecke et al (US 6579343B2), further in view of Ramprasad et al (EP 583748A1) and Voorhees (US 2196281).

As to wherein the absorbed oxygen is released from the liquid medium by passing combustion exhaust gases through the liquid medium in **claim 21**, Cassano (US 4526775) discloses the desorption zones (Col. 4, line 18-40). Cassano **does not teach** the use of stripping gas such as exhaust gas as claimed.

However, Ramprasad et al (EP 583748A1) **teach** method for recovering oxygen from oxygen-containing gaseous mixture (Title). In desorption step of cycle, the operating conditions of the absorber are changed by lowering the pressure and/or raising the temperature of the solution and passing a scrubber gas through the column to scrub at least a portion of the bound oxygen from the metal complex (page 2, line 30-33).

The advantage of using stripping gas for desorption is to improve the performance separation as well known in the art. Both Ramprasad et al, Cassano do not teach the use of exhaust gas as stripping gas. However, it would include the exhaust gas for stripping as evidenced by Voorhees (US 2196281) that stripping gas, for example flue gas, air or steam may be supplied by line 20 at the base of the regenerator and heat may be supplied to the solution in the base of the regenerator by closed steam heating coil 21 (page 1, col. 2, line 19-23).

Therefore, it would have been obvious at time of the invention to install stripper disclosed by Ramprasad et al by using flue gas disclosed by Voorhees for the desorption stage of Cassano in order to achieve the cited advantages.

(8). **Claim 23** is rejected under 35 U.S.C. 103(a) as being unpatentable over Cassano (US 4526775), in view of Brennecke et al (US 6579343B2), further in view of Horn et al (US 6682794B1).

As to absorbed oxygen to be released from liquid medium by catalytically degassing the liquid medium in **claim 23,** Cassano (US 4526775) discloses the desorption zones (Col. 4, line

18-40). Brennecke et al (US 6579343B2) disclose evacuation (Col. 3, line 6). Cassano Brennecke et al **do not teach** catalytically degassing the liquid medium as claimed.

However, Horn et al (US 6682794) **teach** polycarbonate containers (Title). It is prepared by the phase interface process that is characterized in that the aqueous solution of an alkali salt of a bisphenol used, contains dissolved oxygen in an amount less than 150 ppb. (Abstract). Oxygen is removed from the fully deionized water in a manner known in principle, e.g, catalytically, by degassing or by inert gas stripping (Col. 3, line 12-14).

The desorption, evacuation are genus, the catalytically degassing is species, one of ordinary skills in the art would recognize that all species work well for genus, motivated by reasonable expectation of success. In re O'Farrell, 853 F.2d 894, 903, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988).

Response to Arguments

(9). Applicant's arguments, see pages 2-3 current Remarks concerning the new definition of ionic liquids based on the melting point within range of ambient to 100° C, filed on 8/31/2009, with respect to the rejection(s) of claim(s) 12 under teaching of Cassano (US 4526775), Ramprasad et al (EP 583748A1) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Brennecke (US 6579343B2), combined teaching of Cassano (US 4526775), Brennecke et al (US 6579343B2).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to IVES WU whose telephone number is (571)272-4245. The examiner can normally be reached on 8:00 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Examiner: Ives Wu

Art Unit: 1797
Date: December 8, 2009

/Duane Smith/

Supervisory Patent Examiner, Art Unit 1797